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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/824,537

04/15/2004

Tokuhisa Ohiwa

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10/19/2006

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EXAMINER

AU, BACH

ART UNIT

PAPER NUMBER

2822

DATE MAILED: 10/19/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/824,537

Applicant(s)

OHIWA ET AL.

Examiner

Bac H. Au

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 July 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 6-26 is/are pending in the application.
- 4a) Of the above claim(s) 11-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 6-10 and 21-26 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 15 April 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☒ Certified copies of the priority documents have been received in Application No. 09/604,724.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
- Paper No(s)/Mail Date _____.

- 4) ☐ Interview Summary (PTO-413)
- Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Applicant's amendment dated July 7, 2006 in which claims 6, 7, 9 and 10 were amended, and claims 21-26 were added, has been entered.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 6, and 8-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gotoh (U.S. Pat. 5650041) in view of Chapman (U.S. Pat. 5976769) and Ha (U.S. Pat. 6117715).

Regarding claim 6, Gotoh [Figs.2a-h] discloses a method of manufacturing a semiconductor device, comprising:

forming a soluble thin film [4] on a film to be processed [2], the film to be processed formed on a semiconductor substrate [1];

forming a first mask pattern [5] on the soluble thin film;

etching the soluble thin film and the film to be processed [Fig.2e].

Gotoh fails to disclose wherein the soluble thin film contains at least one compound selected from the group consisting of tungsten oxide, aluminum oxide,

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titanium oxide, and titanium nitride; and a step wherein dissolving the etched soluble thin film in a dissolving liquid, thereby lifting off the second mask pattern from the film to be processed. However, Chapman [Figs.9a-c] discloses wherein the soluble thin film [917,918 of Fig.9a] contains at least one compound selected from the group consisting of tungsten oxide, aluminum oxide, titanium oxide, and titanium nitride; and wherein dissolving the etched soluble thin film [917,918] in the dissolving liquid, thereby lifting off the second mask pattern from the film [906] to be processed [Col.6, lines 29-39]. It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teachings of Chapman into the method of Gotoh to include wherein dissolving the etched soluble thin film in the dissolving liquid, thereby lifting off the second mask pattern from the film to be processed. The ordinary artisan would have been motivated to modify Gotoh in the manner set forth above for at least the purpose of overcoming the problem of incomplete removal of photoresist residue by having a liftoff layer, resulting in a more robust photoresist removal method [Chapman; col.1, lines 52-67].

Gotoh fails to disclose the steps of

forming a mask layer on the first mask pattern such that an exposed portion of the soluble thin film is covered with the mask layer;

etching back the mask layer such that an upper face of the first mask pattern is exposed and the portion of the mask layer covering the exposed portion of the soluble thin film remains to form a second mask pattern;

removing the first mask pattern;

etching the soluble thin film and the film to be processed using the second mask pattern as a mask.

However, Ha [Figs.3B-E] discloses a method comprising the steps of:

forming a mask layer [309] on the first mask pattern [306] such that an exposed portion of the soluble thin film [305] is covered with the mask layer;

etching back the mask layer such that an upper face of the first mask pattern is exposed and the portion of the mask layer covering the exposed portion of the soluble thin film remains to form a second mask pattern [Fig.3D];

removing the first mask pattern [Fig.3E];

etching the soluble thin film using the second mask pattern as a mask [Fig.3E].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teachings of Ha into the method of Gotoh to include the steps of forming a mask layer on the first mask pattern such that an exposed portion of the soluble thin film is covered with the mask layer; etching back the mask layer such that an upper face of the first mask pattern is exposed and the portion of the mask layer covering the exposed portion of the soluble thin film remains to form a second mask pattern; removing the first mask pattern; etching the soluble thin film and the film to be processed using the second mask pattern as a mask. The ordinary artisan would have been motivated to modify Gotoh in the manner set forth above for at least the purpose of providing the desired patterning for subsequent processing steps.

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Utilizing multiple steps of masking and patterning in semiconductor processes is well-known.

Regarding claim 8, Chapman discloses wherein the dissolving liquid is either water or alkaline solution [Col.6, lines 29-32].

Regarding claims 9-10, Gotoh discloses

wherein the step of forming the first mask pattern comprises:

forming a first mask layer [5];

forming a resist film [6] with a thickness of 0.3 μm or less on the first mask layer [Col.4, lines 9-16];

patterning the resist film by using photo-lithography technique to form a resist pattern [Figs.2a-c; col.4, lines 5-26]; and

etching the first mask layer using the resist pattern as a mask, thereby forming the first mask pattern [Figs.2a-c; col.4, lines 5-26];

wherein the step of etching the soluble thin film [4] and the film to be processed [2] comprises forming a contact hole in the film to be processed [Fig.2e].

3. Claims 21-22, 24, and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chapman (U.S. Pat. 5976769) in view of Ha (U.S. Pat. 6117715).

Regarding claims 21-22, 24, and 26, Chapman [Figs.2a-h, 3, 9a-c] discloses a method of manufacturing a semiconductor device, comprising:

forming a soluble thin film [208 (217,218; 917,918)] to be dissolved in a dissolving liquid on a film to be processed [206,906], the film to be processed being formed on a semiconductor substrate [202];

forming a second mask pattern [213,214; 911,912] such that an exposed portion of the soluble thin film is covered with the second mask pattern;

etching the soluble thin film and the film to be processed using the second mask pattern as a mask [Figs.2e-g, 3, 9b]; and

dissolving the etched soluble thin film in the dissolving liquid, thereby lifting off the second mask pattern from the film to be processed [Fig.9c];

wherein the soluble thin film [208 (217,218; 917,918)] contains at least one compound selected from the group consisting of tungsten oxide, aluminum oxide, titanium oxide, and titanium nitride;

wherein the dissolving liquid is either water or alkaline solution [Col.6, lines 29-32];

wherein the step of etching the soluble thin film and the film to be processed comprises forming a contact hole in the film to be processed [Fig.3].

Chapman fails to disclose in claim 21 the steps of
forming a first mask pattern on the soluble thin film;

forming a second mask pattern such that an exposed portion of the soluble thin film is covered with the second mask pattern and an upper face of the first mask pattern is exposed; and

removing the first mask pattern.

However, Ha [Figs.3B-E] discloses a method comprising the steps of:

forming a first mask pattern [306] on the soluble thin film [305];

forming a second mask pattern [309] such that an exposed portion of the soluble thin film is covered with the second mask pattern and an upper face of the first mask pattern is exposed [Fig.3D]; and

removing the first mask pattern [Fig.3E].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teachings of Ha into the method of Chapman to include the steps discussed. The ordinary artisan would have been motivated to modify Chapman in the manner set forth above for at least the purpose of providing the desired patterning for subsequent processing steps. Utilizing multiple steps of masking and patterning in semiconductor processes is well-known.

4. Claims 7 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chapman (U.S. Pat. 5976769) in view of Ha (U.S. Pat. 6117715) as applied to claims 21-22 above, and further in view of Rioult (U.S. Pat. 4322264).

Regarding claims 7 and 23, Chapman and Ha discloses most of the claim limitations, but fails to disclose wherein the soluble thin film contains at least one

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compound selected from the group consisting of tungsten oxide, aluminum oxide, and titanium oxide. However, Rioult [Figs.1-3] discloses wherein the soluble thin film [3] contains at least one compound selected from the group consisting of tungsten oxide, aluminum oxide, and titanium oxide [Col.4 lines 3-11].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teachings of Rioult into the method of Chapman and Ha to include wherein the soluble thin film contains at least one compound selected from the group consisting of tungsten oxide, aluminum oxide, and titanium oxide. The ordinary artisan would have been motivated to modify Chapman and Ha in the manner set forth above for at least the purpose of having a suitable alternative material that is well-known and widely used in the art which could also be deposited at a relatively low temperature [Rioult; col.3 lines 8-11].

5. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chapman (U.S. Pat. 5976769) in view of Ha (U.S. Pat. 6117715) as applied to claim 21 above, and further in view of Gotoh (U.S. Pat. 5650041).

Regarding claim 25, Chapman and Ha fail to disclose the limitations of the claim. However, Gotoh [Figs.2a-c] discloses wherein the step of forming the first mask pattern comprises:

forming a first mask layer [5];

forming a resist film [6] with a thickness of 0.3 μm or less on the first mask layer

[Col.4, lines 9-16];

patterning the resist film by using photo-lithography technique to form a resist pattern [Figs.2a-c; col.4, lines 5-26]; and

etching the first mask layer using the resist pattern as a mask, thereby forming the first mask pattern [Figs.2a-c; col.4, lines 5-26];

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teachings of Gotoh into the method of Chapman and Ha to include the steps discussed. The ordinary artisan would have been motivated to modify Chapman and Ha in the manner set forth above for at least the purpose of providing the desired patterning with a high level of precision [Gotoh; col.2 lines 19-24].

Response to Arguments

6. Applicant's arguments filed on July 7, 2006 have been fully considered but they are not persuasive. Applicant argues that Ha does not teach "forming a soluble thin film". This is respectfully traversed. The claim is not so limited as to how or to what the thin film is soluble. From this standpoint, the thin film in Ha does disclose the claimed "soluble thin film".

Applicant argues the combination of Gotoh and Chapman to teach the lift-off method. Gotoh [Col.4 lines 40-41] discloses that layers 4 and mask layer 5 are removed. Gotoh does not exclude the possibility of a wet etching method in removing these layers. Chapman teaches a lift-off method that is an improvement in the removal

of resist and masking layers. The references are analogous in the art and motivation to combine is given, thus their combination is deemed proper.

Applicant argues the combination of Ha with Gotoh and Chapman, wherein Ha is inconsistent with Chapman's teachings. This argument is not persuasive. Ha is applied for the disclosure of multiple masking and patterning steps. Masking and patterning is well-known in the art and multiple mask patterns are formed for different processing requirements. The combination of Ha with Gotoh and Chapman are proper, as both of these references require masking and patterning steps.

Based on the above reasons, the rejection is maintained.

Conclusion

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

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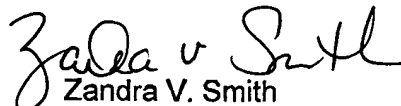
the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Bac H. Au whose telephone number is 571-272-8795. The examiner can normally be reached on Mon-Fri 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Zandra Smith can be reached on 571-272-2429. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

BHA


Zandra V. Smith
Supervisory Patent Examiner
16 Oct. 2006